Being Interdisciplinary: A Look into the Background and Experiences of iSchool Faculty Members

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ABSTRACT

This two-stage study provides an in-depth examination of iSchool's interdisciplinary approach in education and research via the lens of iSchool faculty members' background and experiences. At the first stage, a content analysis of faculty online profiles was conducted to examine faculty members' rank, PhD field, teaching and research descriptions. At the second stage, a survey study was conducted to investigate faculty's interdisciplinary experiences in teaching and research.

Findings show that iSchool faculty members have diverse backgrounds and are actively engaged in various interdisciplinary activities. Their interdisciplinary research is mostly motivated by the nature of research problems, and they consider the gaps of knowledge/experience/vocabulary/disciplinary norms among team members the most frequently encountered challenge. In addition, various factors that contribute to the success of interdisciplinary teaching and education are identified.

This study deepens the understanding of how faculty members work across disciplines in their teaching and research, and yields insights on how to help them overcome challenges and employ effective strategies to accomplish their interdisciplinary objectives. Both educators and researchers can learn from this study how to successfully fuse different disciplines in the study of "information" and create an interdisciplinary environment that truly fosters collaborative research and education.

Keywords: iSchool, interdisciplinary education, interdisciplinary research

1. INTRODUCTION

Library and Information Science (LIS) education is becoming increasingly interdisciplinary, particularly through the iSchool movement. Seeking to address the relationship between information, technology, and people, iSchools represent the emergence of an international information school community involving both renaming current programs and creating new programs (Dillon, 2012). An iSchool "provides the venue that enables scholars from a variety of contributing disciplines to leverage their individual insights, perspectives, and interests, informed by a rich, 'transdisciplinary' community" (Larsen, 2010, p. 3021).

Although the iSchool community's origins can be traced to a small group of U.S. schools that offered ALA-accredited degrees, it has now grown into an international community, including not only former LIS schools, but also schools from other fields such as computer science, and even new academic units created especially for the study of information (Dillon, 2012). As of September 2013, the iSchool Caucus has 52 members, covering a diverse range of programs, mainly from the U.S. but including schools in Australia, the UK, Canada, China, Denmark, Finland, Germany, Ireland, and Singapore. Among the 52 programs, 22 are accredited by the American Library Association (ALA), and all of these ALA-accredited programs are located in the US and Canada. An analysis of the iSchool names revealed that "information" was the dominating word in the names of the schools, as indicated in Figure 1. A variety of other words were also present in the school names, depending on the schools' focuses and directions.

Figure 1. Distribution of words in iSchool names.

Dillon (2012) identified three distinctive characteristics of iSchools. First, iSchools' curricula have departed from the agency-focused model of information, which is commonly adopted by traditional LIS schools. Traditional LIS curricula are more focused on services and functions within specific areas of information. In this educational orientation, the emphasis is on roles and responsibilities for professionals, and technology is usually considered more as supportive or supplementary to the skills and practices of the profession. iSchool's curricular approach treats information in more contextual terms, such as through the social, cultural or individual dynamics of creation and use, often coupled with deeper computational content within the coursework. In other words, the emphasis is on leveraging the power of technology and information to enhance human and organizational potential.

Secondly, iSchools believe that the study of information is beyond the realm of any single discipline, and investigating topics related information access, use, storage, and exploitation broadly across social and human contexts requires interdisciplinary

work. This belief has led to diverse faculty hiring in iSchools, where faculty members have doctoral degrees in multiple fields such as LIS, computer science, and psychology. They operate together in a shared research and education space.

Thirdly, the commitment to research productivity is an important characteristic of identity among iSchools. In the recruitment and evaluation of faculty, research output carries more weight than teaching and service activities. Meanwhile, the emphasis on researching fundamental information problems in society is critical to the iSchool identity and a major criterion for membership of the iSchool caucus.

This study seeks to further understand the second characteristic of iSchools identified by Dillon (2012) – being interdisciplinary, via the lens of iSchool faculty members' background and experiences. To develop a grounded understanding of the interdisciplinary approach to studying "information", this study examines the faculty members' interdisciplinary involvement in teaching and research as well as their perception on the experiences, and proposes ideas to support interdisciplinary endeavors and to promote a culture that values interdisciplinarity and fosters interdisciplinary collaboration.

2. LITERATURE REVIEW

The goal of interdisciplinarity is to "integrate knowledge or modes of thinking in two or more disciplines or established areas of expertise to produce a cognitive advancement... in ways that would have been impossible or unlikely through single disciplinary means" (Boix Mansilla & Durasig, 2007, p. 29). It has been well established in the literature that interdisciplinary approaches are necessary for attacking the most critical social and technological challenges facing the nation and the world nowadays. In higher education settings, the disciplinary departmental structure is slow to respond to interdisciplinary problems (Brainard, 2002; National Institutes of Health, 2006; National Science Foundation, 2006; Borrego & Newswander, 2011). Recognizing this, universities are becoming increasingly engaged in interdisciplinarity.

Borrego and Newswander (2011) examined over 3,000 faculty openings to understand how interdisciplinary trends are represented in new faculty hiring. Their findings indicated that doctoral institutions emphasized interdisciplinary departments or colleges, while baccalaureate colleges had institution-wide interdisciplinary identities and stressed interdisciplinary teaching; natural sciences highlighted interdisciplinary research and collaboration, while social sciences and humanities emphasized interdisciplinary teaching and scholarship; and senior rank positions called for interdisciplinary collaboration experience, while junior rank positions described interdisciplinary teaching responsibilities. This study showed that although interdisciplinary engagement varied depending on institution type, subject fields and faculty's academic rank, it focused on two areas: interdisciplinary education for students, and interdisciplinary research among faculty. This literature review is organized by these two areas.

2.1 Interdisciplinary Education

Interdisciplinary programs in higher education foster individualized student learning experience that allow for the innovative integration of multiple fields of study (Holley,

2009a). An interdisciplinary approach on the theoretical, practical, and pedagogical levels is crucial to students' capacity to think critically (Riggs & Hellyer-Riggs, 2010). More specifically, Spelt, Biemans, Tobi, Luning and Mulder (2009) stated that interdisciplinary higher education aims to develop boundary-crossing skills, such as interdisciplinary thinking. Interdisciplinary thinking was defined as "the capacity to integrate knowledge of two or more disciplines to produce a cognitive advancement in ways that would have been impossible or unlikely through single disciplinary means" (p. 365). The sub-skills of interdisciplinary thinking included knowledge of disciplines, knowledge of disciplinary paradigms, knowledge of interdisciplinarity, higher-order cognitive skills, and communication skills. Spelt et al. (2009) concluded from a comprehensive literature review that interdisciplinary thinking within the context of higher education was influenced by three conditions: 1) students (personal characteristics and prior social/educational experiences); 2) learning environment (curriculum, teacher, pedagogy, and assessment); 3) learning process (pattern and learning activities)

As more institutions undertake efforts to meet the growing demand for interdisciplinarity, researchers have started identifying best practices related to interdisciplinary education. Holley (2009b) adopted the framework of transformative change to study 21 research universities' interdisciplinary efforts. Findings from the study indicated that implementing interdisciplinary initiatives is accomplished not only through changes in how institutional work is organized and the facilities in which the work is carried out, but also through concurrent shifts in the institutional culture related to interdisciplinary endeavors. Holley (2009b) grouped the findings into five transformational change strategies: senior administrative support, collaborative leadership, flexible vision, faculty/staff development, and visible action.

In another study, Holley (2009a) confirmed that successful interdisciplinary programs require the collective engagement of faculty, administrators, and students from across the institution, and these programs reflect a dynamic process that incorporates people, ideas, and artifacts from multiple disciplines in a manner that achieves a distinctive outcome. Holley (2009a) identified eight best practices related to interdisciplinarity in higher education: dedicated organizational and physical space; student centered pedagogy; focus on problem- or theme-based learning; curriculum shaped through a variety of interdisciplinary learning experiences; culminating capstone project or senior portfolio; focus on collaborative learning rather than mastery of particular content; use of independent study, internships, and experiential learning; and goal to prepare students for a complex, modern and interdisciplinary future.

To further understand the characteristics of interdisciplinary programs, Knight, Lattuca, Kimball and Reason (2012) developed typologies to describe the multiple ways in which the programs are structured with respect to curricular and organizational features. Cluster analysis was conducted to study 408 interdisciplinary programs at 37 institutions. Regarding curriculum requirements, five clusters were identified based on the percentage of total required credits within the interdisciplinary program, and the total number of required credits for graduation; regarding organizational features, four clusters were determined based on the percentage of the faculty members with an appointment within the program and whether or not the program director's appointment is within or outside the program. The typology developed in this study suggested that organizational and curricular features would

ultimately affect student learning, and the authors thus called for future research to focus on whether different types of interdisciplinary programs are associated with different kinds or levels of student learning outcomes.

2.2 Interdisciplinary Research

Interdisciplinary research is defined as “any study or group of studies undertaken by scholars from two or more distinct scientific disciplines. The research is based upon a conceptual model that links or integrates theoretical frameworks from those disciplines, uses study design and methodology that is not limited to any one field, and requires the use of perspectives and skills of the involved disciplines throughout multiple phases of the research process” (Aboelela et al., 2006, p. 340). The literature is abundant with studies that provide a strong conceptual justification for interdisciplinary studies and promote the institutional and societal benefits of such research (Klein, 1996; Armstrong, 2006; Kessel, Rosenfield & Anderson, 2008; Repko, 2008). Empirical research also confirmed that interdisciplinary research led to high research productivity and increased density of various relationship networks (Haines, Godley & Hawe, 2011; Kodama, Watatani & Sengoku, 2013).

Given the rising popularity of interdisciplinary research, it becomes necessary to examine how interdisciplinary research was conceptualized and operationalized from the researcher's perspective and therefore to understand how best to facilitate interdisciplinary research success. Nair, Dolovich, Brazil and Raina (2008) conducted qualitative interviews with health researchers about their interdisciplinary research experience, and found that the overriding theme that emerged from the data was “it's all about relationships” (n.p.). An important incentive for doing interdisciplinary research was the engagement with others where there was a mutual respect, comfort and in many cases a past history of working together. It was crucial to cultivate interdisciplinary relationships, and leadership and role clarification were deemed as drives that could foster this development. The authors also learned that working in large teams was not seen as a productive mode of research, and often working closely with one to three people was considered the ideal as a smaller group would better allow for focused attention and integration regarding what each discipline could contribute to the study.

Another qualitative study conducted by Shrimpton and Astbury (2011) investigated researchers' motivations for doing interdisciplinary research, which included a desire to solve complex problems, the drive to produce relevant and useful outcomes, opportunistic motives such as grant and employment opportunities, and intrinsic motives such as enjoying collaborative work. The study also identified a range of purported barriers to conducting interdisciplinary research, including time, funding, disciplinary and epistemic divides, diminished publication possibilities, university structures and policies, and impact on career progression.

Lorenzetti and Rutherford (2012) undertook a grounded theory study to investigate factors that impact health librarians' participation in interdisciplinary research, and the factors included: 1) lack of recognition of the contributions that librarians make to interdisciplinary research; 2) team members' resistance toward librarians' participation in interdisciplinary research; 3) difficulty for librarians to develop the competencies and confidence necessary to engage on an equal footing with other team members; 4) a certain amount of self-doubt; 5) clarity in communications; 6)

significant time investment; 7) passive organization support; and 8) lack of mentoring support of other librarian colleagues.

While the above studies focused on researcher's individual experiences in interdisciplinary research, two others examined interdisciplinary research teams as a whole and identified key attributes important to the collaborative success. Lakhani, Benzies and Hayden (2012) conducted a comprehensive review of literature from medicine, nursing and psychology, and concluded that team purpose, goals, leadership, communication, cohesion, mutual respect and reflection were most essential to interdisciplinary research team effectiveness. Lyhall, Bruce, Marsden and Meagher (2013) conducted multiple case studies and found that the success of research teams hinges upon five factors: locus of interdisciplinary (the way in which interdisciplinarity is situated within a research team), catalysis (deliberate steps to achieve integration and coherence), inspiring leadership, active management, and continuous learning and capacity building.

2.3 Interdisciplinarity in iSchools

Despite iSchools' active promotion of the interdisciplinary approach to study information, there has not been any research effort that specifically studies interdisciplinarity in iSchools. This study seeks to fill that void by examining iSchool faculty's interdisciplinary experiences, and therefore provide a more in-depth understanding of how to better support and facilitate interdisciplinary research and education in iSchools.

3. A TWO-STAGE STUDY

A two-stage study was conducted to examine iSchool faculty members' interdisciplinary experiences in teaching, research and professional activities. This section is organized by the study stage. For each stage, the detailed study design and findings are discussed.

3.1 Stage I.

In the first stage of the study, a content analysis was conducted to study iSchool faculty online profiles. The purpose of this content analysis was to provide a descriptive context for iSchool faculty members' interdisciplinary activities.

At the time of the study (June 2013), there were 41 members of the iSchool caucus, and the website of each school was carefully examined to locate faculty profiles. Among the 41 schools, twelve were excluded from the study because of two reasons: 1) information presented on the website was in a language other than English; 2) the website lacked access to faculty profiles.

Since the focus of the study was to understand iSchool faculty's interdisciplinary experience in teaching and research, only faculty members that have both teaching and research responsibilities were included in the study. In the United States, tenured and tenure-track faculty members fall under this category and their titles are usually "assistant professor", "associate professor" and "professor". In the UK and Australia, faculty members titled "lecturer" or "senior lecturer" also have the dual responsibilities of teaching and research, and therefore met the inclusion criteria of the study.

A total number of 863 faculty members from 29 iSchools were identified and included in the study. Each faculty member's online profile, including personal websites and curriculum vitae linked from the online profile, was examined for the following information: academic rank, field of PhD study, description of teaching, and description of research. The degree of profile details varied greatly from school to school, and from individual to individual, and not all profiles contained complete information about the above four items.

Among the 863 faculty members, 39.2% were professors, 31.6% were associate professors, 23.9% were assistant professors, and 5.3% were senior lecturers or lecturers. This data indicated that the majority of current iSchool faculty members were of senior ranks (close to 70% were professors or associate professors).

A total of 592 faculty members listed the field of their PhD degree on their online profile and the distribution is shown in Table 1 below. Among them, the dominant field was computer science. More than one-fourth of the faculty members had a degree in computer science. Overall, the distribution of the degree fields demonstrated a high level of variety, encompassing not only numerous singular subject fields but also interdisciplinary fields.

PhD Field	%
Computer Science	25.3
Information Science	16.6
Library and Information Science	11.3
Fields in social sciences such as psychology, sociology, linguistics, cognitive science and behavioral science	7.6
Communication and media studies	6.6
Fields in sciences and applied sciences such as physics, chemistry, mathematics, astronomy, biology and statistics	6.3
Education	4.9
Fields in the humanities such as literature, language, history, philosophy, anthropology and archeology	4.7
Economics, business, management, operational and organizational research	3.5
Engineering	1.9
Administration, policy, government and political science	1.7
Law and medicine	0.5
Interdisciplinary fields (e.g. physics and computer science, information science and cognitive science, engineering and public policy, education and anthropology)	9.1
TOTAL	100.0

Table 1. Distribution of iSchool faculty members' PhD degree fields

When examining the description of the faculty members' teaching and research, the unit of analysis couldn't be identified due to significant inconsistencies between the online profiles. In the descriptions of teaching, some faculty members listed the titles of the courses they taught, and some others merely stated their teaching interests or areas. These statements of teaching interests or areas also displayed

inconsistencies as some were brief and general, and some others were specific and detailed. In the descriptions of research, a variety of terms were used, such as research interests, research focuses, areas of expertise and specializations; and the descriptions also varied greatly – some faculty members only outlined the broad fields where they conduct research, while some others depicted their research pursuit in detail.

Given that the unit of analysis couldn't be determined for the descriptions of teaching and research, regular content analysis could not proceed. Alternatively, a visual approach was employed and word clouds were created to graphically capture the content of these descriptions.

Regarding teaching, 618 faculty members provided some form of description. The following criteria applied when including the content of the teaching descriptions to generate the word cloud:

- Titles of courses listed on the faculty online profile (note: some only listed recent semesters, some listed all, and some others did not specify)
 - Each course title was only included once
 - Course titles without any topical/subject information (e.g. internship, practicum, professional experience) were excluded
 - Level number (e.g. I., II.) of a course was removed
- Descriptive statements about teaching interests or areas

A total of 822 faculty members provided descriptive information about their research on their online profile. Only explicit statements about one's research fields, areas, interests, specializations or focuses were included. For example, such a statement could be "Dr. XXX's research interests include..." or "Dr. XXX conducts research in the areas of...". Other descriptive information about the faculty member's research achievements, such as introduction of ongoing projects and summary of publications, was excluded.

Figure 2 shows that the majority of the courses had the word "information" in its title. A noticeable number of courses were introduction courses, and seminar seemed to be a common course format. The popular topics included information systems, design and management. Given the frequent occurrences of the word "research" in course titles, one of iSchool's three characteristics, emphasis on research, appeared to have been reflected in the curriculum.

The survey was active for three weeks and an email reminder was sent out one week before the closing date. A total of 135 survey responses were gathered, yielding a response rate of 16.3%. This was a relatively low response rate, but not surprising due to the online format. Usually online survey response rates are 11% below mail and phone surveys, and rates as low as 2% have been reported (Monroe & Adam, 2012). The average online survey response rate is 10 to 15% (Surveygizmo.com, 2010), and given that, this study showed above-average performance in generating responses.

The online survey examined iSchool faculty members' interdisciplinary experiences in professional activities, teaching and research. The data in Table 2 following shows that the majority of the respondents had interdisciplinary involvement in professional activities, often in more than one of these activities, and the two most popular were attending conferences and serving as journal reviewers in more than one discipline.

Interdisciplinary Involvement	%
I attend conferences/workshops/symposiums in two (or more) different disciplines.	77.7
I serve as reviewers for professional publications or grant agencies in two (or more) different disciplines.	71.9
I'm a member of professional associations in two (or more) different disciplines.	60.7
My appointment is interdisciplinary: 1) I have joint appointment in schools/departments from two (or more) different disciplines; or 2) I work in an interdisciplinary academic unit; or 3) I have appointment in a discipline different than that of my research training.	33.3
I don't have any interdisciplinary involvement in my professional activities.	5.9

Table 2. iSchool faculty's interdisciplinary involvement in professional activities.

Regarding interdisciplinary involvement in teaching, as shown in Table 3 below, three activities were selected by more than 70% of the respondents: teaching courses with interdisciplinary contents, using textbooks and readings from other disciplines, and having students from multiple disciplines.

Interdisciplinary Involvement	%
I teach courses whose contents combine two (or more) different disciplines.	74.8
I use textbooks and readings from other disciplines.	71.9
My courses are attended by students from two (or more) different disciplines.	71.1
I invite guest speakers from other disciplines.	57.0
My assignments require students to interact with people from other disciplines.	31.9
I teach courses in schools/departments from two (or more) different disciplines.	30.4
I co-teach with instructors from other disciplines.	21.5
I don't have any interdisciplinary involvement in my teaching.	3.7

Table 3. iSchool faculty's interdisciplinary involvement in teaching.

Research-wise, each type of the interdisciplinary involvement listed on the survey received votes from more than 60% of the respondents, and only 1 respondent

indicated that he/she did not have any interdisciplinary research activity, as shown in Table 4.

Interdisciplinary Involvement	%
I cite scholarly work in other disciplines in my own publications.	90.4
I draw upon theories from other disciplines in my own research.	87.4
I regularly read scholarly work or publish in other disciplines.	82.2
My research has been cited by publications in other disciplines.	77.8
I collaborate with researchers from other disciplines in conducting research studies.	77.1
I co-write grant proposals with researchers from other disciplines.	69.6
I co-publish with researchers from other disciplines.	67.4
I engage in constant conversations with researchers from other disciplines to spark research ideas and opportunities for interdisciplinary collaboration.	62.2
I serve on the advising panel for doctoral students in other disciplines.	62.2
I don't have any interdisciplinary involvement in my research.	0.7

Table 4. iSchool faculty's interdisciplinary involvement in research.

Each respondent was asked to identify the top two motivations for them to engage in interdisciplinary research from a list of four. As shown in Figure 4 below, the two most popular motivations were the nature of the research and the opportunity to gain new knowledge/perspective. In addition, respondents reported three additional motivations:

- A philosophical need to study information from the interdisciplinary perspective, as shown in the quotes *"A belief that disciplinary boundaries are pernicious, blocking understanding of phenomena at the deepest levels"* and *"The intellectual questions that interest our field and the changes we hope to bring about in the world demand multiple methods of investigation, multiple methods of instruction, and multiple means of application"*.
- Having an interdisciplinary academic or professional background, as indicated in the quotes *"My previous professional experience as a practitioner working across professional and disciplinary boundaries"* and *"PhD in other area, continued collaborations with colleagues from education and psychology"*.
- Personal interest in conducting collaborative and interdisciplinary research.

Figure 4. Motivations for iSchool faculty to engage in interdisciplinary research.

In terms of challenges they encountered in conducting interdisciplinary research, the respondents' opinions showed divergence. As shown in Figure 5 below, even the most widely acknowledge challenge, the various kinds of gaps among team members, was selected by less than 50% of the respondents. Additionally, respondents shared two more challenges:

- Difficulty in ensuring administrative support for interdisciplinary research, as indicated in the quotes *“Administrative challenges imposed by rigid University boundaries (vis a vis management of grant funding and allocating ‘credit’ for grants)”* and *“iSchool administration is MGMT IS/HCI and exclude interdisciplinary views that don't agree with the its”*.
- Difficulty in identifying appropriate venues to publish interdisciplinary research.
- Limited time and available funding.

Figure 5. Challenges encountered by iSchool faculty in interdisciplinary research.

The survey also contained two open-ended questions. The first one sought to understand the most important factors that contribute to students' mastery of interdisciplinary thinking. The responses were two-layered. Some respondents pointed to the qualities that students need to master interdisciplinary thinking, including:

- Logic, critical and multi-perspective thinking skills, as indicated in this quote *"Learning to see the world from different perspectives -- each discipline has its own perspective, to be interdisciplinary you have to be able to see the same thing from multiple perspectives and make sense of it"*.
- Mastering the basic knowledge of the theories, vocabulary, and methods in multiple disciplines and understanding how they relate to each other, how they can be used appropriately, and how to handle the dissonance that arises when there are conflicts.
- Ability to analyze and coalesce materials from different disciplines, as shown in this quote *"Analysis and convergence of data and information from multiple disciplines to answer complex questions"*.
- Open-mindedness, more specifically, being able to recognize the contribution of theories from other disciplines, being appreciative of and respectful for other perspectives, being curious about and open to new ways of thinking.
- Being adaptive, empathetic and comfortable with ambiguity.

To achieve these qualities, some respondents suggested the methods they considered effective:

- Faculty members having knowledge and experience in multiple disciplines and modeling interdisciplinary thinking in their teaching.
- Engaging students in class discussions about interdisciplinary thinking and imparting a commitment to understanding the history and context of disciplinary perspectives.
- Adopting a problem focus instead of a disciplinary focus and designing problem-based learning activities that require students to apply interdisciplinary knowledge and approaches.
- Exposing students to readings in different disciplines and guiding them in the exploration of *"the relationship between theoretical perspectives and empirical examples from various viewpoints and disciplinary frames"*.
- Providing opportunities for students to collaborate or interact with people from other disciplines, or role-play as someone with a different perspective.
- Students having academic degrees in more than one discipline, as shown in this quote *"Formal training/socialization into more than one discipline is really important. I teach in archives, and most of our students have undergraduate backgrounds that are all over the map--and come in very handy for them to pursue an interdisciplinary course"*.

The second open-ended question inquired about the respondents' thoughts on what contributes most to the success of interdisciplinary research. Twelve qualities were identified:

- A good research problem that could truly benefit from an interdisciplinary collaboration.
- Shared interest, goals, passion and commitment to success among the interdisciplinary research team members.
- A positive attitude toward other disciplines than one's own, manifested in:
 - appreciation of and respect for the value each discipline brings to interdisciplinary research;
 - equal value placed on different kinds of contributions from the various disciplines, both conceptually and methodologically;
 - willingness to learn about other disciplines' theories, methods, and conventions; and
 - willingness to truly engage with other disciplinary perspectives rather than assuming a division of labor.
- Ability to operate from a multi-perspective viewpoint.
- Willingness and ability to network and nurture long term collaborations among diverse researchers, as shown in this quote *"Scholars who consistently immerse themselves in other or related domains over a substantial period are more likely to be successful than those who engage in serendipitous and opportunistic discipline-hopping"*.
- Personal traits, including open-mindedness, curiosity, patience, persistence, flexibility, adaptability and humor.
- Personal chemistry between team members.
- Clear and frequent communications between team members.
- Aptitude in understanding complex problems.
- A mutually beneficial approach to publication and valuation of interdisciplinary research, as shown in this quote *"figuring out a way to have this type of work valued by the academy (tenure and promotion). For example - in some disciplines - conference proceedings are the coin of the realm - etc"*.
- Ability to see the "big picture" and focus on the problem, which requires researchers to *"set aside the idea of INTER"*.
- Being team players, as indicated in this quote *"Researchers who are willing to admit mistakes and learn from each other. Researchers who are not trying to carve out the most optimal situation for themselves, but for the project as a whole, while recognizing and respecting the individual researchers' needs"*.

4. DISCUSSION

This study showed that iSchool faculty members are actively engaged in interdisciplinarity. They have academic training in diverse fields, ranging from computer science to literature, and the majority of them have interdisciplinary involvement in professional activities, teaching and research. Implications of the study findings are discussed in this section.

4.1 Enhancing Interdisciplinary Education

Interdisciplinary teaching aims to help students achieve interdisciplinary thinking, and iSchool faculty members identified a number of factors that contribute to this critical skill. Their ideas were consistent with what has been reported in the literature (Spelt, et al., 2009; Holley, 2009a, 2009b). One of the ideas was concerning the background of the instructor, who needs to have “knowledge and experience in multiple disciplines and modeling interdisciplinary thinking in their teaching”. This study found that merely 9.1% of the faculty members received their PhDs in an interdisciplinary area. While the rest of the faculty members came from diverse disciplines, they did not necessarily have sufficient interdisciplinary training. In order for them to be well-equipped with multi-disciplinary knowledge and model interdisciplinary thinking in their teaching, it is important to provide various kinds of support for them. Spelt et al. (2009) proposed several solutions:

- Create an intellectual community focused on interdisciplinarity.
- Help teachers gain expertise on interdisciplinarity.
- Achieve a consensus on interdisciplinarity.
- Foster team development and team teaching.

In alignment with Spelt et al.’s solutions, one of the iSchool faculty members’ own ideas to cultivate interdisciplinary thinking among students, “engaging students in class discussions about interdisciplinary thinking and imparting a commitment to understanding the history and context of disciplinary perspectives”, was also applicable in developing an academic culture that promotes interdisciplinarity and supports interdisciplinary faculty development. A constant discussion among the faculty about interdisciplinarity via workshops, seminars and funding support will help faculty members become more well-versed in interdisciplinarity and more prepared to teach interdisciplinary classes. In addition, while Spelt et al. (2009) suggested team teaching as a solution to enhance interdisciplinary education, currently only a little more than one fifth of iSchool faculty members were co-teaching classes with instructors from other disciplines, suggesting that more effort is needed to encourage and facilitate team teaching.

Regarding pedagogy, “adopting a problem focus instead of a disciplinary focus” was considered important to students’ mastery of interdisciplinary thinking and boundary-crossing skills. This echoed Holley’s (2009a) finding that problem- or theme-based learning was key in interdisciplinary education. Holley’s (2009a) rationale was that the role of curriculum should be shifted from mastery of disciplinary content to the critical integration of multiple bodies of knowledge relative to a specific question. Another important approach to achieve interdisciplinary thinking was “providing opportunities for students to collaborate or interact with people from other disciplines,

or role-play as someone with a different perspective”. However, only less than one third of iSchool faculty members stated that their assignments require students to interact with people from other disciplines.

Ideas may be drawn from the literature to help iSchool faculty members in course design. Spelt et al. (2009) pointed out that interdisciplinary pedagogy should be aimed at achieving active learning and collaboration. Yang (2009) discussed in detail a few strategies used in making interdisciplinary subjects relevant in a class of both law and non-law students, which could be of use to iSchool faculty members in designing their own assignments. These strategies are supported by the outcome-based model and the principle of constructive alignment:

- A combination of problem-based learning and inquiry-based learning, where students investigate into messy legal problem in their professional context, using the knowledge and skills learned in the subject.
- A combination of problem-based learning and role play, where students are provided with hands-on practice opportunities in handling matters in the professional context.
- Activity approach manifested in two methods – first, non-law students engaging in dialogue with lawyers on topics drawn from the law subject; secondly, students seeking diverse solutions to legal problems that emerge in the context of students own profession.
- Transforming traditional lectures into interactive lectures – for example, post-it was used as a way of brainstorming for group discussion of concepts and terms; another example was the Socratic-casebook method, where students gather and present real life legal case stories in their case books and share the cases in small groups for in-depth discussion.

4.2 Facilitating Interdisciplinary Research

iSchool faculty members are involved in various interdisciplinary research activities, ranging from consulting theories and literature in other disciplines, collaborating with researchers in other disciplines, to advising doctoral students in other disciplines. Only a modicum of 0.7% of the surveyed faculty members claimed no involvement in interdisciplinary research.

When examining the faculty members’ motivations to engage in interdisciplinary research and the challenges they encountered in the process, this study drew upon findings from two qualitative studies discussed earlier in the literature review (Nair et al., 2008; Shrimpton & Astbury, 2011) to design the survey questions, and calculated the frequency distribution of the responses to provide a detailed depiction of which motivations and challenges were shared by more faculty members. Such knowledge will help iSchools better understand the more predominant issues in interdisciplinary research and therefore prioritize resources to address them.

The most popular motivation for iSchool faculty members to conduct interdisciplinary research is the nature of the research question. It will be helpful to create opportunities for them to recognize research questions that could benefit from an interdisciplinary approach. Such opportunities may involve offering a forum for them to exchange research ideas and explore potential collaboration. This study found that although a little more than 60% of the faculty members already engage in constant

conversations with researchers from other disciplines to spark research ideas and opportunities for interdisciplinary collaboration, close to 40% of them still find it difficult to identify appropriate research collaborators from other disciplines. Therefore more efforts are needed to assist faculty members in recognizing research questions that are interdisciplinary in nature and identify potential collaborators. One idea is to invite successful interdisciplinary researchers to share their experience and lessons. Another is to provide venues where faculty members from multiple disciplines can meet and converse about their research. For example, Laprise and Thivierge (2012) discussed the innovative approach of using speed dating sessions to foster collaboration among medical professionals. A 35-minute speed dating session was carried out during a 2-hour faculty development workshop, and the majority of the participants were satisfied with it and believed that the method was a stimulating and efficient way to meet new colleagues, quickly share clinical issues and goals, learn about unexpected but important interdisciplinary issues, and identify opportunities for collaboration.

The challenge encountered by most iSchool faculty members in interdisciplinary research is the gaps of knowledge, experience, vocabulary, and disciplinary norms among team members, which are prone to causing misunderstandings and even impeding the research progress. Bridging these gaps requires mutual respect and appreciation among the team members and their willingness to learn about the theories, methods and conventions in each other's disciplines. To best prepare interdisciplinary researchers, acquiring these qualities should be part of their academic training. Boden, Borrego and Newswander (2011) believed that doctoral students, as future scholars, and their training programs are central to increasing interdisciplinary research capacity. Guided by the theoretical framework of graduate student socialization, they studied the interdisciplinary culture of doctoral programs and the process through which doctoral students learned the culture. They concluded that special attention need to be paid to overcoming organizational barriers to interdisciplinarity related to policies, space, engagement with future employers, and open discussion of the politics of interdisciplinarity. Their study offers helpful ideas on improving interdisciplinary training in doctoral education, which will ultimately lead to more adequately prepared interdisciplinary researchers and more successful collaborations.

Another challenge worth noting is that interdisciplinary research is not being valued equally when tenure and promotion is considered. This could be discouraging to faculty members who are interested in interdisciplinary research. To overcome this challenge, Salas (2013) pointed out that "we should not forget to advocate" (p. 219). It is important that researchers educate their community on the value of interdisciplinary research and what made a difference in applying interdisciplinary perspectives. On the other hand, it is necessary for institutions to develop clear guidelines and criteria to evaluate interdisciplinary research. For example, Kodama et al. (2012) developed key performance indicators for competency-based assessment of academic interdisciplinary research (quantity of work, quality of work, research productivity, interdisciplinarity of research results and intensity of internal collaboration), and proposed to use the product portfolio management method to strategically assess an institution's interdisciplinary research activities.

While some faculty members considered opportunities for funding as a motivation for them to engage in interdisciplinary research, some others find it to be challenge.

Funders are critical to achieving the potential value-added of interdisciplinarity, and they have key roles to play in shaping interdisciplinary initiatives, reviewing and evaluating interdisciplinary research appropriately, building interdisciplinary capacity, encouraging stakeholder engagement, and addressing sustainability of interdisciplinary research (Lyll, Bruce, Marsden & Meagher 2013). It is important that faculty members receive sufficient support in seeking funding for their interdisciplinary research. One solution is to employ a full-time position that assists faculty members in all matters related to grant-seeking, from identifying proper funding sources, facilitating meetings with program officers at the funding agency, to drafting the grant proposal and budgeting. Such support will help faculty members stay focused on their research and maintain their productivity.

Finally, in this study, iSchool faculty members shared their thoughts on what contributes most to the success of interdisciplinary research. Twelve qualities were identified and they reflected the faculty members' ideas of addressing the challenges encountered in conducting interdisciplinary research. For instance, maintaining clear and frequent communications may help the team clarify the role of each member and resolving clashes between different personalities and viewpoints; having shared goals, and respecting and appreciating the value of different disciplines may be helpful to minimize issues related to marginality and power dynamics; networking and nurturing long term collaborations among diverse researchers may contribute to lessening the difficulty of identifying appropriate research collaborators. Overall, these qualities provide a solid basis for understanding how to best support and facilitate interdisciplinary research. iSchools and other LIS programs may draw upon them to devise strategies to make faculty members' interdisciplinary research endeavors more successful.

5. Conclusion

This study provides an in-depth examination of iSchool's interdisciplinary approach in education and research via the lens of iSchool faculty members' background and experiences. Findings of the study are valuable to further understand of how faculty members work across disciplines in teaching and research, and yields insights on how to help them overcome challenges and accomplish their interdisciplinary objectives effectively and efficiently. Both educators and researchers can learn from this study how to successfully fuse different disciplines into the study of "information" and create an interdisciplinary environment that fosters collaborative research and education.

However, there are two limitations of the study that need to be acknowledged. The study focused on iSchool faculty members' personal experiences, and only slightly touched on the content aspect of their interdisciplinary activities. Due to the significant inconsistencies among the faculty online profiles, the content analysis couldn't be conducted on their teaching and research descriptions. The graphic approach, word clouds, could only offer a glimpse into the topical content of the interdisciplinary teaching and research iSchool faculty members were involved in. To enhance the understanding of interdisciplinarity in iSchools, future research is needed to approach the topic from the content perspective and investigate in what ways "information" is studied in an interdisciplinary manner. Another limitation is the low survey response rate. Although it was considered reasonable for online surveys,

it was not ideal. One possible culprit might be that the study was conducted in the summer when fewer people were available.

Overall, this study provides a detailed depiction of iSchool faculty's various interdisciplinary involvement in teaching and research and their perceptions on the experiences. It lays the foundation for further explorations of how to successfully support and facilitate interdisciplinary research and education both in iSchools and other programs that study information. After all, being interdisciplinary is inherent in the study of information, as Machlup and Mansfield (1983) stated, "In its broadest sense, [information science] stands for the systematic study of information and may include all or any combination of the academic disciplines" (p. 18).

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